

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier. Claims 1-4, 6-20, 22, and 23 are now pending in this application.

Claim Rejections under 35 U.S.C. 103

Claims 1-3, 6-8, 10, 13, 15, and 16-20:

In paragraph 3 of the Office Action, Claims 1-3, 6-8, 10, 13, 15, and 16-20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,030,895 (“Joshi”) in view of U.S. Patent No. 6,339,496 (“Edelstein”), and U.S. Patent No. 6,749,699 (“Bogel et al.”). Applicants respectfully traverse this rejection.

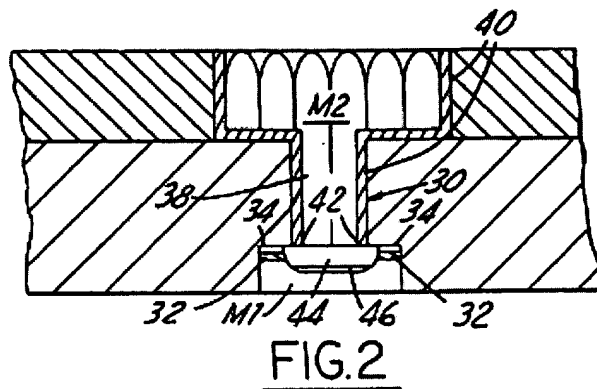
In paragraph 4 of the Office Action, the Examiner states that Joshi discloses “forming a barrier layer (34, 40) (Figure 2) (Col. 4, lines 50-62) along the lateral sidewalls and bottom of a via aperture.” Applicants respectfully disagree. The very section of Joshi cited by the Examiner states:

It should be noted that **at the shoulder portions 42** of the wet etched area 44 in the M1 layer, **the layer of Ti deposited is very thin and in some instances, almost non-existent**. After depositing a second Ti/Al--Cu/Ti layer 38, the Ti layer 40 (which subsequently forms TiAl₃ after 400° C annealing) is only under the via and does not encroach as shown in FIG. 2.

(Col. 4, lines 56-62, emphasis added.)

Joshi teaches that the Titanium layer 40 at the shoulder portion 42 is very thin and in some instances, almost non-existent. Referring still to Fig. 2, Ti/TiN layers 32 and 34 are over portions of M1 but they are not over portions of M1 that interface with via structure M2. As can

be plainly seen in Fig. 2 of Joshi (reproduced below), there is no barrier layer that extends along the lateral side walls and bottom of the via aperture. The barrier layer 40 that extends along the side walls of Joshi ends at the shoulder portion 42, it does not extend over the bottom of the via. It should be noted that “area 46” is shown under the via structure 42 and within the M1 layer. (Col. 4, lines 57-58 identify wet etched area 44 as part of the M1 layer.)



Claim 1 requires: “forming a barrier layer along lateral side walls and a bottom of a via aperture.” Claim 10 requires: “providing a conformal layer section at a bottom and sides of a via aperture positioned over the first conductive layer to form a barrier separating the via aperture from the first conductive layer.” Claim 17 requires: “providing a barrier material at a bottom and sides of the aperture to form a barrier layer.”

The foregoing shows that Joshi does not disclose, suggest, or teach a “barrier layer” that extends both along the lateral side walls and bottom of the via aperture. Further, Joshi does not have a “conformal” layer that conforms along the bottom and sides of the via aperture. Edelstein and Bogel et al. also fail to disclose or suggest these limitations. Taken as a combination, Joshi, Edelstein and Bogel et al. do not disclose or suggest a “barrier” or “conformal” layer along the sides and bottom of the via. For at least this reason, Applicants respectfully request withdrawal of the rejection of Claims 1-3, 6-8, 10, 13, 15, and 16-20.

Claim 4:

In paragraph 13 of the Office Action, Claim 4 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Joshi in view of Edelstein and Bogel et al. and further in view of U.S. Patent No. 6,440,849 (“Merchant”). Applicants respectfully traverse this rejection.

Claim 4 depends from Claim 1 and, thus, requires all of the elements of Claim 1. Merchant alone or in combination with Joshi, Edelstein and Bogel et al. fails to disclose or suggest “forming a barrier layer along lateral side walls and a bottom of a via aperture” recited by Claim 1. As such, the rejection cannot be properly maintained. Applicants respectfully request withdrawal of the rejection.

Claim 9:

In paragraph 14 of the Office Action, Claim 9 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Joshi in view of Edelstein and Bogel et al. and further in view of U.S. Patent No. 6,380,083 (“Gross”). Applicants respectfully traverse this rejection.

Claim 9 depends from Claim 1 and, thus, requires all of the elements of Claim 1. Gross alone or in combination with Joshi, Edelstein and Bogel et al. fails to disclose or suggest “forming a barrier layer along lateral side walls and a bottom of a via aperture” recited by Claim 1. As such, the rejection cannot be properly maintained. Applicants respectfully request withdrawal of the rejection.

Claims 11-12:

In paragraph 15 of the Office Action, Claims 9, 11-12 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Joshi in view of Edelstein and Bogel et al. and further in view of U.S. Patent No. 6,090,710 (“Andricacos”). Applicants respectfully traverse this rejection.

Claims 11-12 depend from Claim 10 and, thus, require all of the elements of Claim 10. Andricacos alone or in combination with Joshi, Edelstein and Bogel et al. fails to disclose or suggest “providing a conformal layer section at a bottom and sides of a via aperture positioned over the first conductive layer to form a barrier separating the via aperture from the first conductive layer” recited by Claim 10. As such, the rejection cannot be properly maintained. Applicants respectfully request withdrawal of the rejection.

Claim 21-22:

In paragraph 18 of the Office Action, Claims 21 and 22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Joshi in view of Edelstein and Bogel et al. and further in view of Merchant. Applicants respectfully traverse this rejection.

Claim 21 was previously cancelled. Claim 22 depends from Claim 17 and, thus, includes all of the elements of Claim 17. Merchant alone or in combination with Joshi, Edelstein and Bogel et al. fails to disclose or suggest “providing a barrier material at a bottom and sides of the aperture to form a barrier layer.” As such, the rejection cannot be properly maintained. Applicants respectfully request withdrawal of the rejection.

Claim 23:

In paragraph 20 of the Office Action, Claim 23 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Joshi in view of Edelstein and Bogel et al. and further in view of Gross. Applicants respectfully traverse this rejection.

Claim 23 depends from Claim 17 and, thus, requires all of the elements of Claim 17. As indicated above, Gross alone or in combination with Joshi, Edelstein and Bogel et al. fails to disclose or suggest “providing a barrier material at a bottom and sides of the aperture to form a barrier layer” recited by Claim 17. As such, the rejection cannot be properly maintained. Applicants respectfully request withdrawal of the rejection.

Applicants believe that the present application is now in condition for allowance.
Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 50-2350. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 50-2350. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 50-2350.

Respectfully submitted,

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By

A handwritten signature in black ink, appearing to read "Paul S. Hunter", is written over a horizontal line.

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